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FOREST TABLES—LODGEPOLE PINE.

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FOREST TABLES—LODGEPOLE PINE.

INTRODUCTION.

In its general investigations the Forest Service has gathered, in tabular form, a great deal of miscellaneous data on tree growth, form, and volume. Much has been published, yet much more has been submitted in routine office reports, which are not widely available. Many of these tables are to be assembled, collated, and edited. While they represent the results of many investigations, and are the best that can be had, they must not be regarded as final, but as suggestions for further investigations, by which they must be tested. Criticism of them is desired, for only through criticism can they be corrected or verified.

The various subjects considered are: Stand tables, by well-recognized types and localities; reproduction; height and diameter growths; volume, by feet and by products; taper measurements; and present and potential yields.

The measurements for lodgepole pine tables were made by field parties in Wyoming in 1901 and 1905 and in Montana in 1902.

STAND TABLES.

The stand tables show the variations in lodgepole pine forests in the northern Rocky Mountain region. They illustrate the forest conditions to which all the tables in the circular apply and are not averages for use in estimating or cruising. They are grouped according to the two broad divisions into which the forests of the northern Rocky Mountain region naturally fall. In the northern section, from the Yellowstone National Forest north through western Montana and eastern Idaho, Douglas fir is an important tree associated with lodgepole pine. In the southern section, from the Big Horn and Medicine Bow Mountains in Wyoming south into northern Colorado and Utah, there is less Douglas fir and the associated tree is Engelmann spruce. The types sometimes blend almost imperceptibly and occur in varying combinations; but the stands given prevail over considerable areas.

NORTHERN SECTION.

The types of the northern section are represented by the following tables: Table 1, lodgepole pine flat; Table 2, lodgepole pine slope; Table 3, Douglas fir slope; Table 4, Alpine or transition type.

The lodgepole pine flat or creek type, as shown in Table 1, contains about 50 per cent pine and 30 per cent Engelmann spruce; the rest is Alpine fir and Douglas fir. This type grows on limited areas along creeks and on other moist situations below 8,000 feet.

TABLE 1.—*Lodgepole pine flat or creek type in Gallatin County, Mont.*

[Trees 6 inches and over in diameter breasthigh on 28 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.	Engelmann spruce.	Alpine fir.	Douglas fir.	Limber pine.	Total of five species
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
6	9.64	7.07	5.46	1.86	.....	.....
7	13.75	8.36	4.71	1.21	.....	.....
8	14.07	6.43	4.54	1.21	.....	.....
9	15.07	5.36	3.50	1.29	.....	.....
10	11.93	5.61	2.43	.93	.....	.....
11	11.07	3.86	2.04	.96	.....	.....
12	9.32	4.07	1.46	.82	.....	.....
13	7.79	3.46	1.25	.71	.....	.....
14	5.43	2.89	.93	.54	.....	.....
15	4.18	2.57	.61	.64	.....	.....
16	2.46	2.14	.39	.54	.....	.....
17	1.75	1.86	.39	.54	.....	.....
18	1.25	1.29	.39	.32	.....	.....
19	.89	1.21	.11	.32	.....	.....
20	.46	1.32	.07	.36	.....	.....
21	.21	.96	.04	.14	.....	.....
22	.18	1.00	.14	.14	.....	.....
23	.21	.79	.04	.07	.....	.....
24	.04	.50	.11	.18	.....	.....
25	.....	.43	.....	.11	.....	.....
26	.07	.39	.04	.04	.....	.....
27	.04	.39	.....	.04	.....	.....
28	.04	.21	.....	.....	.....	.....
29	.....	.....	.04	.....	.....	.....
30	.....	.11	.....	.07	.....	.....
31	.....	.04	.....	.04	.....	.....
32	.....	.04	.....	.07	.....	.....
33	.....	.....	.....	.04	.....	.....
34	.....	.04	.....	.....	.....	.....
37	.....	.04	.....	.....	.....	.....
Total.....	109.85	62.44	28.69	13.19	.....	214.17
Per cent.....	51.29	29.15	13.40	6.16	.....	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	57.32	35.22	10.48	7.62	.....	110.64
Per cent.....	51.81	31.83	9.47	6.89	.....	100.00

Table 2 shows the lodgepole pine slope type, which, in many places, approaches the pure pine stand (75 per cent) and comprises the larger part of the forest up to 8,000 feet.

TABLE 2.—*Lodgepole pine slope type in Gallatin County, Mont.*

[Trees 6 inches and over in diameter breasthigh on 89 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.	Douglas fir.	Engelmann spruce.	Alpine fir.	Limber pine.	Total of five species.
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
6	28.30	4.12	2.82	2.90	0.22	.....
7	29.36	2.90	2.70	2.64	.11	.....
8	25.09	2.47	2.10	2.17	.11	.....
9	21.16	2.16	1.74	1.55	.....	.....
10	18.03	1.80	1.90	1.19	.02	.....
11	15.22	1.35	1.18	.69	.....	.....
12	11.82	1.03	1.20	.69	.....	.....
13	8.60	.88	1.28	.52	.02	.....
14	5.29	.67	.84	.32	.....	.....
15	3.66	.58	.78	.27	.01	.....
16	2.06	.48	.73	.17	.....	.....
17	1.25	.39	.40	.10	.01	.....
18	.82	.33	.46	.18	.01	.....
19	.55	.34	.39	.05	.....	.....
20	.20	.24	.42	.02	.01	.....
21	.16	.17	.24	.02	.....	.....
22	.13	.15	.36	.03	.....	.....
23	.09	.12	.20	.01	.....	.....
24	.02	.15	.15	.05	.....	.....
25	.01	.10	.13	.....	.....	.....
26	.05	.09	.09	.02	.....	.....
27	.01	.03	.11	.01	.....	.....
28	.01	.07	.07	.....	.....	.....
29	.01	.02	.02	.01	.....	.....
30	.....	.08	.03	.....	.....	.....
31	.....	.01	.02	.....	.....	.....
32	.....	.05	.....	.....	.....	.....
34	.....	.....	.01	.....	.....	.....
35	.....	.01	.01	.....	.....	.....
36	.....	.02	.....	.....	.....	.....
37	.....	.....	.01	.....	.....	.....
38	.....	.01	.....	.....	.....	.....
50	.....	.01	.....	.....	.....	.....
Total.....	171.90	20.83	20.39	13.61	.52	227.25
Per cent.....	75.64	9.17	8.97	5.99	.23	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	67.99	9.18	11.03	4.35	0.08	92.63
Per cent.....	73.40	9.91	11.91	4.69	.09	100.00

Table 3 shows the average number of trees per acre of the Douglas fir slope type, which grows on southern and exposed western slopes in the Gallatin Mountains of Montana. In the Yellowstone region it occurs on protected northern and eastern exposures. The type is of limited extent, and occurs below 8,000 feet.

TABLE 3.—*Douglas fir slope type in Gallatin County, Mont.*

[Trees 6 inches and over in diameter breasthigh on 14 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Douglas fir.	Lodgepole pine.	Alpine fir.	Engelmann spruce.	Limber pine.	Total of five species.
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
6	17.64	10.21	0.43	0.21	.....	.....
7	15.50	6.79	.29	.14	.....	.....
8	15.14	6.15	.29	.14	.....	.....
9	8.50	5.50	.36	.07	.....	.....
10	9.79	3.57	.21	.07	0.07	.....
11	6.86	2.57	.....	.....	.....	.....
12	5.57	2.43	.07	.....	.....	.....
13	3.64	1.29	.....	.....	.....	.....
14	4.00	1.29	.....	.....	.....	.....
15	2.07	1.14	.....	.07	.....	.....
16	1.50	.64	.....	.....	.....	.....
17	2.50	.36	.....	.....	.....	.....
18	.86	.29	.....	.....	.....	.....
19	1.07	.07	.....	.....	.....	.....
20	.86	.....	.....	.07	.....	.....
21	.71	.07	.....	.....	.....	.....
22	.36	.21	.....	.....	.....	.....
23	.57	.14	.....	.....	.....	.....
24	.36	.07	.07	.....	.....	.....
25	.50	.....	.....	.....	.....	.....
26	.43	.....	.....	.....	.....	.....
27	.29	.....	.....	.....	.....	.....
28	.43	.....	.....	.....	.....	.....
29	.29	.....	.....	.....	.....	.....
30	.43	.....	.....	.....	.....	.....
31	.07	.....	.....	.....	.....	.....
32	.29	.....	.....	.....	.....	.....
33	.29	.....	.....	.....	.....	.....
34	.14	.....	.....	.....	.....	.....
38	.14	.....	.....	.....	.....	.....
40	.07	.....	.....	.....	.....	.....
42	.07	.....	.....	.....	.....	.....
48	.07	.....	.....	.....	.....	.....
Total.....	101.01	42.79	1.72	.77	.07	146.36
Per cent.....	69.01	29.24	1.17	.53	.05	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	44.23	14.14	0.35	0.21	0.07	59.00
Per cent.....	74.97	23.97	.59	.35	.12	100.00

Table 4 shows the Alpine or transition type, which occurs at 8,000 feet, and changes from the predominating lodgepole pine to Engelmann spruce with Alpine fir, and finally to limber pine or mountain pine. It is a type less important than the other.

TABLE 4.—*Alpine or transition type in Gallatin County, Mont.*

[Trees 6 inches and over in diameter breasthigh on 14 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.	Douglas fir.	Alpine fir.	Engelmann spruce.	Limber pine.	Total of five species.
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
6	18.93	10.29	2.43	1.43	1.43	.....
7	15.64	8.36	1.79	.86	.57	.....
8	9.36	6.57	1.71	1.00	.71	.....
9	8.07	5.64	.64	.50	.....	.....
10	3.86	4.29	.64	.29	.14	.....
11	2.29	3.29	.36	.21	.....	.....
12	1.43	2.07	.14	.21	.....	.....
13	.43	1.21	.14	.07	.29	.....
14	.50	.64	.07	.....	.....	.....
15	.07	.43	.....	.07	.07	.....
16	.07	.71	.....	.....	.....	.....
17	.....	.29	.....	.....	.07	.....
18	.14	.50	.....	.....	.07	.....
19	.14	.43	.....	.....	.....	.....
20	.....	.71	.....	.....	.07	.....
21	.....	.21	.....	.....	.....	.....
22	.....	.36	.....	.....	.....	.....
23	.....	.....	.....	.07	.....	.....
24	.....	.....	.....	.....	.....	.....
25	.....	.07	.....	.....	.....	.....
26	.....	.07	.....	.....	.....	.....
27	.....	.....	.....	.....	.....	.....
28	.....	.07	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....
30	.....	.14	.....	.....	.....	.....
31	.....	.....	.....	.....	.07	.....
Total.....	80.93	46.35	7.92	4.71	3.49	123.40
Per cent.....	49.38	37.56	6.42	3.81	2.83	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	8.93	15.49	1.35	0.92	0.78	27.47
Per cent.....	32.51	56.39	4.91	3.35	2.84	100.00

SOUTHERN SECTION.

The southern section is represented by tables for the Douglas Creek watershed, covering almost 30,000 acres of the Medicine Bow National Forest. The types are: Engelmann spruce type, Table 5; lodgepole pine type, quality I, Table 6; lodgepole pine type, quality II, Table 7; lodgepole pine type, quality III, Table 8.

The Engelmann spruce type (Table 5) grows in bottoms and swales, or in the moister locations generally. Its area is limited, and includes 6 per cent of the Douglas Creek watershed.

TABLE 5.—*Engelmann spruce type in the Medicine Bow National Forest, Wyoming.*

[Trees 4 inches and over in diameter breasthigh on 85 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Engelmann spruce.	Lodgepole pine.		Alpine fir.	Aspen.	Total of four species.
		Sound.	Cull.			
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
4	7.42	2.51	0.16	8.31	0.22	.....
5	8.54	3.59	.28	8.12	.19	.....
6	10.31	5.01	.45	7.49	.13	.....
7	8.87	5.44	.68	5.93	.12	.....
8	8.86	6.16	.68	4.95	.08	.....
9	7.54	6.09	.78	3.87	.18	.....
10	6.61	5.80	.79	2.61	.07	.....
11	5.47	5.73	.76	1.81	.07	.....
12	6.16	5.65	.85	1.32	.06	.....
13	4.56	4.46	.72	.72	.07	.....
14	3.52	3.44	.55	.51	.02	.....
15	3.74	2.45	.52	.33	.....	.....
16	2.52	1.53	.38	.16	.02	.....
17	2.15	1.06	.29	.20	.....	.....
18	1.76	.61	.19	.07	.....	.....
19	1.34	.38	.08	.04	.....	.....
20	1.25	.24	.07	.04	.....	.....
21	.91	.08	.05	.....	.....	.....
22	.80	.07	.01	.01	.....	.....
23	.48	.06	.....	.....	.....	.....
24	.36	.05	.01	.02	.....	.....
25	.21	.....	.....	.....	.....	.....
26	.20	.01	.....	.....	.....	.....
27	.15	.....	.....	.....	.....	.....
28	.13	.....	.....	.....	.....	.....
29	.07	.....	.01	.....	.....	.....
30	.11	.....	.....	.....	.....	.....
31	.11	.....	.....	.....	.....	.....
32	.04	.....	.....	.....	.....	.....
33	.01	.....	.....	.....	.....	.....
35	.01	.....	.....	.....	.....	.....
36	.01	.....	.....	.02	.....	.....
40	.01	.....	.....	.....	.....	.....
41	.01	.....	.....	.....	.....	.....
Total.....	94.24	60.33	8.31	46.53	1.23	210.64
Per cent.....	44.74	28.64	3.95	22.09	.58	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	42.70	31.62	5.28	7.86	0.31	87.77
Per cent.....	48.65	36.03	6.02	8.95	.35	100.00

Table 6 shows the lodgepole pine type, quality I, which includes the best part of the lodgepole pine land, with trees from 75 to 90 feet high. It comprises 3 per cent of the Douglas Creek watershed.

TABLE 6.—*Lodgepole pine type, quality I, in the Medicine Bow National Forest, Wyoming.*

[Trees 4 inches and over in diameter breasthigh on 23.6 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.		Engelmann spruce.	Alpine fir.	Total of three species.
	Sound.	Dead.			
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
4	4.96	0.13	1.57	3.18	.....
5	7.88	.59	2.67	2.54	.....
6	10.76	.64	2.71	2.08	.....
7	13.64	.68	2.46	1.44	.....
8	17.33	1.19	2.50	1.48	.....
9	15.93	.93	2.03	.68	.....
10	19.53	1.61	1.99	.76	.....
11	17.12	1.14	1.82	.38	.....
12	18.60	1.53	2.37	.25	.....
13	13.60	1.19	1.53	.13	.....
14	11.27	.85	1.31	.38	.....
15	7.84	.42	.51	.08	.....
16	5.64	.51	.47	.04	.....
17	4.24	.55	.42	.04	.....
18	2.80	.38	.21	.....	.....
19	1.40	.13	.42	.....	.....
20	.81	.13	.17	.....	.....
21	.38	.21	.38	.....	.....
22	.25	.04	.....	.....	.....
23	.....	.08	.08	.....	.....
24	.....	.04	.08	.....	.....
26	.....	.....	.04	.04	.....
29	.....	.....	.04	.....	.....
Total.....	173.98	12.97	25.78	13.50	226.23
Per cent.....	76.90	5.73	11.40	5.97	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	103.48	8.81	11.84	2.10	126.23
Per cent.....	81.98	6.98	9.38	1.66	100.00

Table 7 gives the lodgepole pine type, quality II, which includes the typical pure lodgepole slopes, on which the trees are 55 to 75 feet high. This type comprises the largest part of the forest—61 per cent in this case—and may be regarded as the average stand.

TABLE 7.—*Lodgepole pine type, quality II, in the Medicine Bow National Forest, Wyoming.*

[Trees 4 inches and over in diameter breasthigh on 889 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.		Engelmann spruce.	Alpine fir.	Aspen.	Cottonwood.	Total of five species.
	Sound.	Cull.					
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
4	13.32	0.30	0.73	1.57	0.01	.....	.....
5	18.13	.78	1.01	1.21	.01	0.01	.....
6	24.49	1.24	1.25	1.25	.01	.....	.....
7	29.37	1.53	1.03	.97	.01	.....	.....
8	31.46	1.98	.94	.80	.01	.....	.....
9	28.06	1.99	.74	.60	.....	.....	.....
10	24.21	2.07	.67	.38	.....	.....	.....
11	18.89	1.78	.56	.27	.....	.....	.....
12	16.26	1.62	.51	.19	.....	.....	.....
13	10.48	1.34	.33	.09	.....	.....	.....
14	7.00	1.07	.32	.07	.....	.....	.....
15	4.73	.85	.21	.04	.....	.....	.....
16	3.00	.57	.21	.02	.....	.....	.....
17	1.65	.37	.13	.02	.....	.....	.....
18	1.09	.28	.11	.02	.....	.....	.....
19	.57	.18	.08	.01	.....	.....	.....
20	.28	.12	.07	.01	.....	.....	.....
21	.16	.06	.05	.....	.....	.....	.....
22	.11	.04	.03	.....	.....	.....	.....
23	.05	.01	.02	.....	.....	.....	.....
24	.03	.01	.02	.....	.....	.....	.....
25	.02	.01	.01	.....	.....	.....	.....
26	.01	.....	.01	.....	.....	.....	.....
27	.02	.....	.01	.....	.....	.....	.....
28	.01	.....	.....	.....	.....	.....	.....
29	.....	.....	.01	.....	.....	.....	.....
Total.....	233.40	18.20	9.06	7.46	.05	.01	268.18
Per cent.....	87.03	6.79	3.38	2.78	.02	.....	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	88.57	10.38	3.36	1.12	.....	.....	103.43
Per cent.....	85.63	10.04	3.25	1.08	.....	.....	100.00

112 Sq. ft basal area

Table 8 gives the lodgepole pine type, quality III, which is found on the higher ridges and slopes. The trees are usually under 55 feet in height and of inferior quality. The type comprises about 30 per cent of the Douglas Creek watershed.

TABLE 8.—*Lodgepole pine type, quality III, in the Medicine Bow National Forest, Wyoming.*

[Trees 4 inches and over in diameter breasthigh on 487 acres.]

AVERAGE TREES PER ACRE.

Diameter breasthigh.	Lodgepole pine.		Alpine fir.	Engelmann spruce.	Total of three species.
	Sound.	Cull.			
Inches.	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
4	26.97	1.68	1.18	0.27	.....
5	33.50	3.38	1.07	.46	.....
6	36.47	4.41	.98	.48	.....
7	34.29	4.51	.62	.33	.....
8	30.40	4.37	.58	.37	.....
9	21.69	3.43	.27	.25	.....
10	16.14	2.98	.23	.21	.....
11	11.05	2.17	.17	.18	.....
12	8.92	2.02	.10	.18	.....
13	5.38	1.35	.06	.11	.....
14	3.37	.93	.05	.11	.....
15	2.24	.71	.03	.09	.....
16	1.47	.45	.01	.06	.....
17	.82	.24	.01	.05	.....
18	.55	.17	.....	.02	.....
19	.26	.10	.....	.01	.....
20	.13	.03	.....	.01	.....
21	.08	.03	.....	.01	.....
22	.06	.03	.....	.....	.....
23	.03	.01	.....	.....	.....
24	.02	.....	.....	.....	.....
25	.01	.....	.....	.....	.....
29	.05	.....	.....	.....	.....
Total.....	233.90	33.00	5.36	3.20	275.46
Per cent.....	84.91	11.98	1.95	1.16	100.00

TREES 10 INCHES AND OVER IN DIAMETER BREASTHIGH.

Total.....	50.58	11.22	0.66	1.04	63.50
Per cent.....	79.65	17.67	1.04	1.64	100.00

REPRODUCTION.

Seedling stand tables are misleading, since they apply only to small areas and do not show general reproduction. They indicate the reproductive possibilities of a tree under certain conditions only. Thus, Table 9 gives the number of seedlings on an area 20 feet by 20 feet, the average of five plots of those dimensions.

TABLE 9.—*Seedling lodgepole pine stand, Gallatin County, Mont.*

Height.	Average trees 20 feet by 20 feet on plot.
Feet.	*Number.*
0.5	6
1.0	19
1.5	18
2.0	61
2.5	79
3.0	128
3.5	70
4.0	46
4.5	26
5.0	18
6.0	4
Total....	475

This would give a stand of more than 50,000 trees per acre, but an acre of such reproduction might not be found in one continuous area. The fact that lodegpole pine reproduces vigorously after fires and in openings where the soil is favorable is well illustrated by the dense mature stands.

Seedling growth varies greatly, and is influenced most by relative light and shade. Table 10 gives the average height attained by 463 seedlings from 2 to 20 years old growing in openings, in Gallatin County, Mont. No trees over 8 feet high were measured; yet some trees from 10 to 20 feet high may have been only 20 years old, or less. Had these been included the average would have been much higher than the arbitrary 8 feet.

TABLE 10.—*Seedling height growth of lodgepole pine in openings, in Gallatin County, Mont.*

Age.	Height.	Basis.	Age.	Height.	Basis.
Years.	*Feet.*	*Trees.*	*Years.*	*Feet.*	*Trees.*
1	0.3	.....	12	3.9	77
2	.6	4	13	4.5	75
3	.8	2	14	5.1	51
4	.9	1	15	5.6	28
5	1.0	1	16	6.1	12
6	1.2	5	17	6.6	18
7	1.5	5	18	7.0	13
8	1.8	11	19	7.5	23
9	2.3	30	20	8.0	7
10	2.8	41			
11	3.3	59	Total....	.....	463

HEIGHT.

According to the explanations of the stand tables, the different types should show varying heights for a given diameter. A tree of 10 inches breasthigh diameter may be 71 feet high on a lodgepole slope in Montana, and 64 feet high in the creek type, where the stand is not so dense. The Alpine or transition type would show a much smaller height for the same diameter. Unfortunately, stem analyses have not been taken on each type, and it is impossible to illustrate each one. However, the lodgepole pine slope of the northern section and lodgepole pine, quality II, of the southern section, which together represent the average types and much the larger areas, are well represented in Table 11, and are directly comparable. The tree in Montana seems to have a slightly greater height for a given diameter than in Wyoming. Trees 13 inches and more in diameter vary little in height for average types in the different sections.

TABLE 11.—*Comparison of average heights of lodgepole pine.*

Diameter breast-high	Lodgepole pine, quality II, Medicine Bow National Forest, Wyoming.		Lodgepole slope, Gallatin County, Mont.		Flat or creek type, Gallatin County, Mont.	
	Height.	Basis.	Height.	Basis.	Height.	Basis.
Inches.	*Feet.*	*Trees.*	*Feet.*	*Trees.*	*Feet.*	*Trees.*
2	.....	.....	21	4	.....	.....
3	.....	.....	31	10	34	1
4	.....	.....	41	12	40	3
5	.....	.....	50	6	45	2
6	.....	.....	57	12	50	1
7	.....	.....	62	13	54	.....
8	59	3	66	94	57	13
9	62	6	69	74	60	14
10	64	34	71	265	63	84
11	67	220	73	248	66	88
12	69	293	74	150	68	60
13	71	239	75	76	71	27
14	73	88	76	82	73	20
15	74	23	77	71	75	34
16	76	1	78	43	77	16
17	.....	.....	79	25	79	16
18	.....	.....	79	16	80	7
19	.....	.....	80	10	81	7
20	.....	.....	81	11	82	3
21	.....	.....	82	2	.....	.....
22	.....	.....	82	7	.....	.....
Total....	.....	907	.....	1,231	.....	396

GROWTH.

Table 12 gives rates of growth for different regions. The first three columns are types that may be compared. Gallatin County, Mont., shows the best rate of growth, the Bighorn region next, and the Medicine Bow region shows an exceedingly slow growth. These

figures apply to the greater proportion of the lodgepole forests. The creek type of the Gallatin, Mont., district shows a comparatively rapid growth and may be accepted as a maximum applicable to less than 5 per cent of the forest.

These tables are very general and show that in this region lodgepole pine growth is very slow, though on exceptionally favorable situations like the creek type it is fairly rapid. The degree to which the climatic factors and the varying densities affect the growth is not discernible in these figures.

TABLE 12.—*Comparisons of average diameter growth of lodgepole pine.*

Age.	Slope type.						Creek type, Gallatin County, Mont.	
	Gallatin County, Mont.		Bighorn National Forest, Wyoming.		Medicine Bow National Forest, Wyoming.			
	Diameter breast-high.	Basis.	Diameter breast-high.	Basis.	Diameter breast-high.	Basis.	Diameter breast-high.	Basis.
Years.	*Inches.*	Decade measurements on about 2,000 stumps of various heights, 80 to 175 years old.	*Inches.*	Decade measurements on 49 stumps of various heights, 72 to 340 years old.	*Inches.*	Decade measurements on 430 1-foot stumps, 150 to 300 years old.	*Inches.*	Decade measurements on 193 stumps of various heights up to 175 years old.
20	2.2		1.5		0.3		2.5	
30	4.0		3.0		1.6		4.6	
40	5.4		4.4		2.8		6.4	
50	6.6		5.7		3.7		8.0	
60	7.7		6.7		4.4		9.4	
70	8.7		7.6		5.0		10.7	
80	9.6		8.4		5.6		11.8	
90	10.5		9.1		6.2		12.8	
100	11.2		9.7		6.7		13.8	
110	11.9		10.3		7.2		.....	
120	12.5		10.7		7.7		.....	
130	13.0		11.1		8.2		.....	
140	13.5		11.6		8.6		.....	
150	14.0		12.1		9.1		.....	
160	.....		12.5		9.6		.....	
170	.....		12.8		10.0		.....	
180	.....		13.2		10.4		.....	
190	.....		13.5		10.8		.....	
200	.....		13.8		11.1		.....	

The increased diameter growth through openings made by logging is shown in Table 13, which compares the diameters that trees may attain in ten, twenty, and thirty years after logging with those of the unopened stands. Readings were made on 395 stumps on land cut over ten, twenty, and thirty years ago in the Medicine Bow National Forest. A growth rate was calculated excluding the ten, twenty, and thirty year readings, and from this the virgin growth shown in the third, fifth, and seventh columns was obtained. By tabulating the increase in growth covered by the last ten, twenty, and thirty years the figures in the first column were obtained. The first ten years after logging is seen to make little difference, and is evidently needed in recovering from suppression, but in thirty years there is considerable difference for the smaller trees. For instance, a 2-inch tree after thirty years reaches a diameter of 4.65 inches in a logged stand,

but only 3.85 inches in the dense stand—a gain of 0.8 of an inch in thirty years. This increase of growth diminishes in the larger trees, so that a 9-inch tree in a logged stand shows an advantage of only 0.05 of an inch in thirty years. Evidently the larger, mature, and dominant trees have little to gain by the opening up of the stand.

TABLE 13.—*Increase of diameter growth due to logging, Medicine Bow National Forest, Wyoming.*

Diameter breasthigh at present time.	Diameter after 10 years.		Diameter after 20 years.		Diameter after 30 years.	
	If logged.	Not logged.	If logged.	Not logged.	If logged.	Not logged.
Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
2	2.70	2.70	3.65	3.35	4.65	3.85
3	3.55	3.55	4.30	4.05	5.10	4.50
4	4.55	4.45	5.20	4.90	5.90	5.35
5	5.55	5.40	6.20	5.85	6.90	6.30
6	6.55	6.45	7.20	7.00	7.90	7.50
7	7.55	7.50	8.20	8.05	8.90	8.55
8	8.55	8.55	9.15	9.05	9.85	9.65
9	9.55	9.55	10.15	10.15	10.80	10.75
10	10.55	.....	11.15	.....	11.80	.....
11	11.50	.....	12.10	.....	12.75	.....
12	12.50	.....	13.10	.....	13.75	.....
13	13.45	.....	14.00	.....	14.65	.....
14	14.45	.....	15.00	.....	15.60	.....
15	15.40	.....	15.95	.....	16.55	.....
16	16.40	.....	16.90	.....	17.45	.....
17	17.35	.....	17.80	.....	18.35	.....
18	18.30	.....	18.70	.....	19.20	.....

For accurate rates of height growth, measurements must be taken at uniform heights from the ground to the top and accurate ring counts made on each cross section. Unfortunately, in the lodgepole pine analyses these counts were not made above the stump section. This difficulty is sometimes bridged by the indirect method of reading across the age-diameter and diameter-height curves; for example, a 60-year old tree in a specified type has a diameter of 7.7 inches breasthigh and the height corresponding to a 7.7-inch diameter is 65 feet; therefore a tree 60 years old should be 65 feet high. A growth-height table may be constructed in this way, but since its silvicultural accuracy is questionable, it is not included.

VOLUME.

BOARD FEET.

Table 14 gives the volume in board feet, Scribner log rule, for trees of various diameters and heights, with a top cutting limit of 6 inches inside bark. The table was constructed from trees cut in the Gallatin region of Montana, but the height class division makes it applicable to any region or type where the height is known.

The 1,817 trees measured for this table were cut and scaled as 16-foot and 10-foot logs. A uniform 10-foot log would give a slightly higher board foot volume.

TABLE 14.—*Volume of lodgepole pine, board measure, Gallatin County, Mont.*

[Cut into 16-foot and 10-foot logs to a top diameter of 6 inches inside bark and scaled by Scribner log rule.]

Diameter breast-high.	Height of tree in feet—						Basis of trees.
	50.	60.	70.	80.	90.	100.	
Inches.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Number.*
10	50	65	75	90	105	125	495
11	60	75	90	105	125	155	478
12	75	90	105	125	150	185	296
13	90	105	125	145	180	215	146
14	105	125	145	170	215	250	120
15	.....	140	170	200	250	285	113
16	.....	160	195	230	285	315	60
17	.....	.....	225	260	315	350	44
18	.....	.....	250	290	350	385	25
19	.....	.....	275	320	380	420	17
20	.....	.....	300	345	415	460	14
21	.....	.....	.....	375	450	495	2
22	.....	.....	.....	400	490	530	6
23	.....	.....	.....	430	525	565	.....
24	.....	.....	.....	455	560	600	1
Total	.....	.....	.....	.....	.....	.....	1,817

CUBIC FEET.

Table 15 gives the total volume of the stem in cubic feet. To reduce this to merchantable wood an allowance of 12 per cent must be deducted for bark, stump, and a 4-inch top. The bark alone forms about 6 per cent of the total volume. The allowances for top above 4 inches inside bark and for a stump 1 foot high vary greatly with the diameter and only slightly with the height. The allowance for a 10-inch tree is 6 per cent, which was taken as the average. This, added to the 6 per cent bark allowance, gives the total allowance of 12 per cent. The variation in the allowance for stump and top is as follows:

Diameter breasthigh of tree.	Ratio of 1-foot stump and 4-inch top to total volume.
Inches.	*Per cent.*
6	18
8	7
10	6
12	5
14	5
16	5

TABLE 15.—*Volume of lodgepole pine, cubic contents, Gallatin County, Mont.*

Diameter breast-high.	Height of tree in feet—							Basis.
	30.	40.	50.	60.	70.	80.	90.	
Inches.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Trees.*
4	1.2	1.7	2.3	2.8	.....	.....	.....	16
5	2.4	3.0	3.8	4.7	.....	.....	.....	11
6	.....	4.5	5.6	6.9	8.2	9.4	.....	14
7	.....	.....	7.6	9.3	11.0	12.8	.....	13
8	.....	.....	10.0	12.0	14.0	16.5	19.0	53
9	.....	.....	12.5	15.0	17.5	20.5	23.0	71
10	.....	.....	15.5	18.0	21.0	24.5	27.5	136
11	.....	.....	18.5	21.5	25.0	28.5	32.5	73
12	.....	.....	21.5	25.0	29.0	33.0	37.5	71
13	.....	.....	.....	29.0	33.0	37.5	42.5	34
14	.....	.....	.....	32.5	37.5	43.0	48.5	34
15	.....	.....	.....	36.5	42.0	48.0	54.5	27
16	.....	.....	.....	.....	47.0	54.0	61.0	22
17	.....	.....	.....	.....	52.0	59.5	67.5	18
18	.....	.....	.....	.....	57.0	65.5	74.0	19
19	.....	.....	.....	.....	62.5	71.5	81.0	13
20	.....	.....	.....	.....	68.0	77.5	87.5	11
21	.....	.....	.....	.....	73.5	83.5	94.0	3
22	.....	.....	.....	.....	.....	89.5	101.0	5
Total....	.....	.....	.....	.....	.....	.....	.....	644

BOX BOARDS.

Since the box board industry now uses lodgepole pine, a table of the contents of trees in "wany" and round-edged boards would be convenient. Such a table can be constructed from Table 15 by converting the cubic feet into board feet of wany-edged boards, according to the following relation, which holds for second-growth white pine in New Hampshire, cut with a one-fourth-inch circular saw, and which will apply to lodgepole pine closely utilized:

Diameter breast-high.	Board feet per cubic foot of total volume.	Diameter breast-high.	Board feet per cubic foot of total volume.
Inches.		*Inches.*	
6	4.0	15	6.1
7	4.6	16	6.2
8	5.0	17	6.2
9	5.4	18	6.3
10	5.6	19	6.3
11	5.8	20	6.4
12	5.9	21	6.5
13	6.0	22	6.5
14	6.1		

The board feet given in this tabulation are actual saw cut and not Scribner rule. The relation is per cubic foot of total volume, stump, top, and bark included. Thus, to find the actual contents in board feet of a 6-inch tree when sawed into round-edged box boards, its volume in cubic feet (see Table 15) must be multiplied by 4. This factor increases with the diameter of the tree and reaches 6.5 for a 22-inch tree. It also increases very slightly with the height of a tree, but for practical purposes the figures apply to all heights.

TIES AND PROPS.

Two tie and prop volume tables are given. Table 16 was constructed from taper curves, and only first-grade ties, 6 inches by 8 inches by 8 feet, are included. The rest of the stem to 6 inches is regarded as mine props. This table should be used where tie inspection is very rigid, and second-grade and cull ties are not merchantable. It allows a large part of the tree to go into props.

TABLE 16.—*Average number of first-class railroad ties and mine props in lodgepole pine, based on taper curves, Gallatin County, Mont.*

Diameter breast-high.	Height in feet—							
	60.		70.		80.		90.	
	Ties.	Props.	Ties.	Props.	Ties.	Props.	Ties.	Props.
Inches.	*Number.*	*Feet.*	*Number.*	*Feet.*	*Number.*	*Feet.*	*Number.*	*Feet.*
10	1.2	27.0	1.3	31.0	1.4	39.0	.....	.....
11	2.2	20.0	2.4	25.0	2.8	27.5	.....	.....
12	2.6	17.5	3.1	22.0	3.6	23.0	4.4	24.5
13	3.0	16.0	3.6	19.0	4.3	19.0	5.2	20.0
14	3.5	13.0	4.1	16.5	4.7	17.5	5.7	19.0
15	3.9	11.5	4.5	14.5	5.1	15.5	6.1	17.0
16	.....	.....	4.8	13.0	5.4	14.0	6.4	15.5
17	.....	.....	4.9	12.5	5.5	13.5	6.6	14.0
18	.....	.....	5.1	12.0	5.8	12.5	6.8	13.0
19	.....	.....	5.3	11.0	5.9	11.5	6.9	12.5
20	.....	.....	5.4	10.5	6.0	11.0	7.0	12.5
21	.....	.....	.....	.....	.....	.....	7.1	12.0
22	.....	.....	.....	.....	.....	.....	7.2	11.0

Table 17 is based on a study of trees actually cut for ties in the Medicine Bow National Forest in Wyoming. Trees above 15 inches are more valuable for lumber, and were not cut for ties in this forest. Second-grade and cull ties were worth more than mine props; so the number of ties does not refer to first grade alone, but includes about 25 per cent of second-grade ties. For the smaller diameters the percentage of second-grade ties is much larger.

The length of props in both tables is given in linear feet, in order to facilitate the calculation when props of varying lengths are desired.

TABLE 17.—*Average number of first and second class railroad ties and of mine props in lodgepole pine, based on actual cutting, Medicine Bow National Forest, Wyoming.*

Diameter breast-high.	Height of tree in feet—										Basis.
	50.		60.		70.		80.		90.		
	Ties.	Props.	Ties.	Props.	Ties.	Props.	Ties.	Props.	Ties.	Props.	
Inches.	*No.*	*Feet.*	*No.*	*Feet.*	*No.*	*Feet.*	*No.*	*Feet.*	*No.*	*Feet.*	*Trees.*
10	2.0	17	2.3	21	2.5	25	3.0	29	.....	.....	32
11	2.4	13	2.7	18	3.0	21	3.6	25	4.0	28	219
12	2.8	12	3.2	15	3.5	19	4.1	21	4.5	24	292
13	3.3	11	3.6	14	4.0	17	4.7	19	4.9	21	239
14	3.7	11	4.0	13	4.5	15	5.1	17	5.4	19	89
15	4.0	11	4.4	13	5.0	14	5.5	15	5.8	17	23
Total	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	894

APPLICATION OF VOLUME TABLES TO STANDING TIMBER.

In applying the volume tables to standing timber in the estimate of yield for the Douglas Creek watershed of the Medicine Bow National Forest, Wyoming, the following percentages were deducted for cull trees, defects, and open spots:

Pine forest.

	Per cent.
Quality I	25
Quality II	30
Quality III	35

Spruce forest.

Pine	30
Spruce	15

This deduction is ample for ties, props, and lumber. For box boards and pulpwood the deduction would probably be much less.

FORM.

BUTT TAPER.

Table 18 gives the diameters outside bark, at 1 foot intervals, from the ground to a height of 5 feet, for trees of a given diameter breasthigh. It can be used for estimating the breasthigh diameter when stumps only remain. It also gives an idea of the height and amount of the root swelling.

TABLE 18.—*Butt taper of lodgepole pine as shown by diameter outside bark, Medicine Bow National Forest, Wyoming.*

Diameter breast-high.	Height from ground in feet—					Basis.
	1.	2.	3.	4.	5.	
Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Trees.*
5	5.5	5.4	5.2	5.1	4.9	5
6	6.6	6.4	6.2	6.1	5.9	18
7	7.8	7.4	7.2	7.1	6.9	25
8	8.9	8.4	8.2	8.1	7.9	69
9	10.0	9.4	9.2	9.1	8.9	99
10	11.1	10.4	10.2	10.1	9.9	122
11	12.2	11.5	11.2	11.1	10.9	136
12	13.3	12.5	12.2	12.1	11.9	104
13	14.4	13.6	13.2	13.1	12.9	75
14	15.6	14.7	14.2	14.1	13.9	45
15	16.8	15.8	15.3	15.1	14.9	22
16	18.0	16.9	16.4	16.1	15.9	9
17	19.3	18.1	17.5	17.1	16.9	6
Total						735

TAPER OF STEM.

Table 19 gives the comparative diameters inside the bark of lodgepole pine trees of various diameters and heights. This table was prepared from data collected in Gallatin County, Mont., but the form does not vary materially in other regions.

The table may be used in finding the probable number of various sized poles with a specified top diameter that may be cut from a given stand, provided the average height is known. For example, if it is

desired to know the number of poles with a 7-inch top that may be got from a stand in quality II in Wyoming with an average height of 60 feet, the taper table for 60 feet will show that a 10-inch tree will yield a 30-foot pole, allowing for a reasonable stump; an 11-inch tree will yield a 30-foot pole; a 12-inch tree a 35-foot pole, and so on. By multiplying by the number of trees of each diameter in the stand and making the proper allowance for cull trees and defects, the estimated yield in poles of different sizes may be obtained. To insure accuracy this table, as all other forest tables, should be applied to a number of trees.

TABLE 19.—*Stem taper of lodgepole pine, as shown by diameter inside bark, Gallatin County, Mont.*

TREES 60 FEET IN HEIGHT.

Diameter breast-high.	Height from ground in feet—										Basis.
	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	
Inches.	*Inches.*	*Inches.*	*Inches.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Trees.*
10	10.0	9.2	8.8	8.5	8.0	7.3	6.6	5.9	.....	.....	50
11	10.8	10.0	9.5	9.0	8.4	7.6	6.8	6.0	5.2	4.5	50
12	11.6	10.8	10.2	9.6	8.8	8.0	7.1	6.2	5.4	4.6	51
13	12.6	11.6	11.0	10.3	9.4	8.5	7.5	6.5	5.6	4.7	17
14	13.5	12.5	11.8	11.1	10.3	9.3	8.1	7.0	5.9	4.9	9
15	14.5	13.4	12.7	12.0	11.1	10.0	8.8	7.5	6.3	5.1	9
Total...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	186

TREES 70 FEET IN HEIGHT.

Diameter breast-high.	Height from ground in feet—												Basis.
	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	
Inches.	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Trees.*
10	10.1	9.3	8.8	8.5	8.1	7.7	7.1	6.5	5.8	5.1	4.5	3.8	50
11	11.1	10.1	9.6	9.2	8.7	8.2	7.7	7.0	6.3	5.5	4.8	4.0	50
12	12.1	11.0	10.3	9.8	9.3	8.7	8.2	7.5	6.8	5.9	5.1	4.1	49
13	12.9	11.9	11.1	10.5	9.9	9.3	8.7	8.0	7.2	6.3	5.4	4.3	50
14	13.8	12.7	11.9	11.2	10.5	9.9	9.2	8.5	7.6	6.6	5.6	4.5	50
15	14.8	13.5	12.6	11.9	11.2	10.5	9.7	8.9	7.9	6.9	5.8	4.7	42
16	15.8	14.5	13.5	12.7	11.9	11.2	10.3	9.4	8.4	7.2	6.1	4.9	16
17	16.9	15.5	14.4	13.5	12.6	11.8	10.9	9.8	8.7	7.5	6.3	5.1	12
18	17.9	16.4	15.3	14.3	13.3	12.4	11.3	10.2	9.0	7.7	6.5	5.2	7
19	18.8	17.3	16.0	15.0	14.0	13.0	11.9	10.7	9.4	8.0	6.7	5.4	3
20	19.8	18.1	16.8	15.7	14.6	13.5	12.4	11.1	9.7	8.2	6.8	5.5	2
Total...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	331

TREES 80 FEET IN HEIGHT.

Diameter breast-high.	Height from ground in feet—													Basis.
	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	65.	
Inches.	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Ins.*	*Trees.*
10	9.7	9.1	8.8	8.6	8.3	7.9	7.5	7.1	6.6	6.0	5.4	4.8	4.3	50
11	10.7	10.0	9.7	9.4	9.0	8.6	8.1	7.6	7.0	6.4	5.7	5.1	4.4	50
12	11.8	10.9	10.5	10.1	9.7	9.2	8.7	8.1	7.5	6.8	6.0	5.3	4.6	50
13	12.7	11.8	11.3	10.8	10.4	9.9	9.4	8.7	8.0	7.2	6.3	5.5	4.8	47
14	13.7	12.7	12.1	11.5	11.0	10.5	9.9	9.2	8.4	7.6	6.7	5.8	4.9	41
15	14.7	13.6	12.9	12.3	11.7	11.1	10.5	9.7	8.9	8.0	7.0	6.0	5.1	38
16	15.8	14.6	13.7	13.0	12.4	11.8	11.1	10.3	9.4	8.4	7.3	6.2	5.2	28
17	16.8	15.4	14.5	13.8	13.1	12.4	11.6	10.7	9.8	8.7	7.6	6.4	5.3	20
18	17.8	16.3	15.3	14.5	13.8	13.0	12.2	11.2	10.2	9.1	7.9	6.7	5.5	10
19	18.7	17.1	16.0	15.1	14.3	13.5	12.6	11.7	10.6	9.4	8.2	6.9	5.6	10
20	19.6	17.9	16.7	15.7	14.8	14.0	13.1	12.1	11.0	9.7	8.4	7.1	5.7	2
Total..	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	346

TABLE 19.—*Stem taper of lodgepole pine, as shown by diameter inside bark, Gallatin County, Mont.*—Continued.

TREES 90 FEET IN HEIGHT.

Diameter breast-high.	Height from ground in feet—							
	5.	10.	15.	20.	25.	30.	35.	40.
Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
12	11.8	10.9	10.6	10.4	10.1	9.8	9.4	8.9
13	12.8	11.9	11.5	11.2	10.9	10.5	10.1	9.6
14	13.8	12.9	12.4	12.0	11.7	11.3	10.8	10.3
15	14.8	13.8	13.2	12.8	12.4	12.0	11.5	10.9
16	15.8	14.7	14.1	13.6	13.2	12.7	12.2	11.5
17	16.8	15.6	14.9	14.4	14.0	13.5	12.9	12.2
18	17.7	16.5	15.7	15.2	14.6	14.1	13.5	12.7
19	18.7	17.2	16.4	15.8	15.2	14.6	13.9	13.1
20	19.7	18.1	17.2	16.4	15.8	15.1	14.4	13.5
21	20.6	18.9	17.8	17.0	16.3	15.6	14.8	13.9
22	21.6	19.7	18.5	17.6	16.9	16.1	15.3	14.3
Total.....								

Diameter breast-high.	Height from ground in feet—							Basis.
	45.	50.	55.	60.	65.	70.	75.	
Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Trees.*
12	8.4	7.8	7.2	6.5	5.7	4.8	.....	16
13	9.1	8.4	7.8	7.1	6.3	5.3	4.3	10
14	9.7	9.0	8.3	7.5	6.7	5.8	4.7	3
15	10.3	9.5	8.8	8.0	7.1	6.1	4.9	21
16	10.8	10.0	9.2	8.3	7.4	6.3	5.2	13
17	11.3	10.4	9.6	8.6	7.6	6.4	5.3	8
18	11.8	10.8	9.9	8.9	7.8	6.6	5.4	6
19	12.2	11.2	10.2	9.1	8.0	6.7	5.5	4
20	12.6	11.5	10.4	9.3	8.1	6.8	5.6	7
21	12.8	11.7	10.6	9.4	8.2	6.9	5.6	2
22	13.2	12.0	10.8	9.6	8.3	7.0	5.7	3
Total.....								93

YIELD.

PRESENT.

As a general index of the yield in board feet, the following estimates are given:

Yield per acre in board feet, Gallatin County, Mont.

[Cutting to a diameter breasthigh of 11 inches.]

Type.	Lodgepole pine.	Douglas fir and Engelmann spruce.
	Board feet.	
Creek	5,900	No yields computed.
Eastern slope	7,200	
Western slope	3,800	
Northern slope	7,000	

Yield per acre in board feet, Douglas Creek watershed of the Medicine Bow National Forest, Wyoming.[a]

[Cutting to a diameter breasthigh of 11 inches.]

Type.	Area.	Lodgepole pine.	Engelmann spruce.	Total.
	Acres.	*Board feet.*	*Board feet.*	*Board feet.*
Pine forest:				
Quality I	704	11,300	1,000	12,300
Quality II	18,276	6,200	200	6,400
Quality III	8,738	2,700	60	2,760
Spruce forest	1,616	2,700	4,700	7,400
Average for tract	29,334	5,200	500	5,700

[a] This yield was first computed as a mixed product of ties, props, and lumber. The ties were credited with 33⅓ board feet each, and the props with 1 board foot for each linear foot, since a 10-foot prop, 6 inches at the small end, scales 10 board feet by Scribner's decimal C rule.

Cutting pine trees 11 inches to 15 inches in diameter for ties and props; 16 inches and up for lumber; and all spruce for lumber, the yield for the same area given above in the Medicine Bow National Forest is as follows:

Yield per acre, in board feet, Medicine Bow National Forest, Wyoming.

Type.	Lodgepole pine.			Spruce lumber.
	Ties, 6 inches by 8 inches by 8 feet.	Props.	Lumber.	
	Number	*Linear feet.*	*Board feet.*	*Board feet.*
Pine Forest:				
Quality I	200	1,100	3,000	1,000
Quality II	130	600	1,100	200
Quality III	50	240	550	60
Spruce forest	55	230	700	4,700
Average for tract	108	500	1,100	500

FUTURE.

The growth rate tables hardly permit a prophecy of the future yield beyond a very general statement. Different types and localities will differ in their yields for a given period. On some areas a second cut may be made after a lapse of 30 years and an equal number of ties removed, if no trees are cut below 11 inches breasthigh diameter and if the smaller trees are properly protected. That the present board measure yield could be reproduced in such a short period is doubtful.

Approved:

JAMES WILSON, *Secretary of Agriculture.*

WASHINGTON, D. C., *October 2, 1907.*

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